

vertebræ, which appear to be not fewer than nineteen, and may have numbered twenty-six. The sacral vertebræ are deeply cupped, and the sacral ribs are developed as in *Nothosaurus* and *Pareiasaurus*. The sacral ribs form part of the articular face of the first sacral vertebra. The pelvis is imperfectly known; the ilium is not so extended as in *Dicynodonts*, and conforms to the type of *Phocosaurus*, which is regarded as *Theriodont*. The pubis and ischium are united together on the *Dicynodont* plan, but are only moderately developed.

The scapular arch is completely known, and is formed of scapula, coracoid, and pre-coracoid as in *Dicynodon* and *Pareiasaurus*. The humerus and bones of the fore limb were relatively short, and only fragments have been preserved which appear to be referable to ulna and radius.

The hind limb is known from several examples of the femur, which resembles that of *Pareiasaurus* in the proximal end, but at the distal end is more like the type described as *Saurodesmus*.

The tibia is known from its proximal and distal ends; it has a general resemblance to that of *Pareiasaurus*, but is more slender. These types are regarded as constituting a distinct group, named *Deuterosauria*, which is in many respects intermediate between the *Placodontia* and *Theriodontia*, but in skull structure appears also to approach *Nothosaurs* and *Plesiosaurs*.

XIV. "The Menstruation of *Semnopithecus entellus*." By WALTER HEAPE, M.A., Balfour Student at the University of Cambridge. Communicated by Professor M. FOSTER Sec. R.S. Received May 16, 1893.

(Abstract.)

The specimens used in the following investigation were collected in Calcutta in 1891.

The phenomena attending menstruation are grouped into four periods, and these are subdivided into eight stages:

- A. Period of rest. Stage I. The resting stage.
- B. Period of growth. Stage II. The growth of stroma. Stage III. The growth of vessels.
- C. Period of degeneration. Stage IV. The breaking down of vessels. Stage V. The formation of lacunæ. Stage VI. The rupture of lacunæ. Stage VII. The formation of the menstrual clot.
- D. Period of recuperation. Stage VIII. The recuperation stage.

The body of the uterus consists of an internal mucosa and external muscle layers. The mucosa is composed of uterine and glandular epithelium, blood vessels, a few radial muscles, and stroma. The

stroma has the appearance of embryonic mesoderm, the internuclear protoplasm is drawn out into very delicate processes forming a continuous network; there is no intercellular substance to be seen, and a few long radial fibrils are present during the resting stage only. It is a very primitive tissue.

Period A.

Stage I.—The uterine epithelium is a single row of cubical cells; its outer edge is sharply defined in section but the protoplasm of the base of the cells is continuous with the protoplasmic processes of the stroma.

The glandular epithelial cells are columnar; they rest on a basement membrane but have no sheath.

Round nuclei are embedded in the protoplasmic network of the stroma, which is evenly disposed for one-third of the depth of the mucosa, while below that a few radially arranged fibrils occur.

The blood vessels are small and fairly numerous.

Period B.

Stage II.—An increase in the number of the nuclei of the stroma by amitotic division and probably by fragmentation, causes swelling and increase of density in the upper third of the mucosa—hyperplasia. Owing to pressure the nuclei become fusiform. An enlargement of vessels takes place. No decidua cells are formed.

Stage III.—The mucosa is further swollen. The epithelium is stretched and becomes thinner. Hyperplasia of the vessels directly below the epithelium takes place and they are congested.

The size of many of the nuclei of the stroma is reduced.

Period C.

Stage IV.—Hypertrophy of the uterine epithelium of the stroma and of the walls of the vessels appears all over the mucosa: followed by degeneration in the superficial region, where the dilated, congested capillaries break down, the blood contained therein being extravasated amongst the stroma.

The degeneration is probably amyloid or hyaline, not fatty degeneration.

A considerable increase in the number of the leucocytes in the superficial vessels takes place.

There is no migration of leucocytes and no diapedesis of red blood corpuscles, but where vessels are ruptured a few leucocytes are swept out together with red blood corpuscles, into the surrounding tissue; many leucocytes, however, remain attached to the remnants of the walls of the broken-down vessels.

Stage V.—The extravasated blood now collects into lacunæ which are first formed within the stroma but gradually extend superficially, displace the intervening stroma elements and lie directly in contact with the epithelium.

The vessels in the deeper mucosa remain intact; there is no trace of diapedesis and no red blood corpuscles or leucocytes in the stroma in this region.

Stage VI.—The lacunæ increase in size. The uterine epithelium and superficial stroma shrivel up and exhibit signs of degeneration. The epithelium ruptures and the blood contained in the lacunæ is poured into the uterine cavity.

Stage VII.—Denudation follows. All the uterine epithelium, a portion of the glands and in some places a whole gland, and a depth of about one-third of the layer of the stroma is cast away, together with ruptured vessels, red blood corpuscles and leucocytes. Of these substances the menstrual clot is formed.

This is a severe, devastating, periodic action which is very remarkable.

A ragged surface is left behind and the remaining stroma contains, at or near the surface, masses of extravasated blood. In the deeper parts of the mucosa there is no further change.

Period D.

Stage VIII.—The recuperation consists of the re-formation of the epithelium, partly from the torn edges of the glands and partly by means of the transformation of stroma elements into flat epithelium; of the formation of new capillaries in the superficial region out of the stroma cells which surround the intercellular spaces in which the extravasated blood lies, and in the return of this reclaimed blood to the circulatory system; of the return of the vessels in the deeper mucosa to their normal size and consistency, and of the return of the stroma to the condition of rest (Stage I).

The new epithelium, at first flattened, becomes cubical, and new glands are formed from folds of this epithelium.

The numerous leucocytes left with the extravasated blood are returned to the circulatory system with the latter; they do not migrate, they do not form new tissue *in situ* or pus on the wounded surface.

Ovulation.

Out of the ovaries of forty-two specimens of menstruating *S. entellus* only two were found in which recent discharged follicles were seen. Such a result appears to be sufficient to warrant the statement that—

1. Ovulation does not necessarily occur during each menstrual period, and
2. That menstruation is not brought about by ovulation.

The two corpora lutea seen occurred in specimens of Stage III and Stage IV; during these stages the first great increase of the blood supply to the mucosa takes place, and it therefore appears possible that the increased supply of blood to the generative organs during the early stages of menstruation may possibly induce ovulation when a sufficiently ripe ovum is present in the ovaries; there is direct proof, however, that an ovum is not dehiscent at each menstrual period.

Conclusion.

Recent observations show that periods of growth and degeneration occur in the mucosa of the bitch when rutting, but denudation is not described. There is good reason to believe that the period of growth is invariably present in the mucosa of rutting animals, and, as ovulation and rut are stated to be coincident, it appears highly probable that the period of growth during menstruation represents the preparation of the mucosa for the reception and retention of an ovum, while the degeneration period represents the result of failure to fertilise the ovum or failure of ovulation.

I venture to express the belief that the function of menstruation may be thus expressed, but I fail to find any evidence of the origin of menstruation.

Note.—Since the above was written, I have seen Marshall's book on 'Vertebrate Embryology' (1893), in which he also divides the phenomena of menstruation into four stages, identical with my four Periods A, B, C, and D. The arrangement was arrived at independently.

XV. "Studies in the Morphology of Spore-producing Members. Part I. Equisetineæ and Lycopodineæ." By. F. O. BOWER, D.Sc., F.R.S., Regius Professor of Botany in the University of Glasgow. Received June 9, 1893.

(Abstract.)

Two preliminary statements have already been communicated on this subject ('Roy. Soc. Proc.,' vol. 50, p. 265, and vol. 53, p. 19), dealing with some of the observations made during work extending over more than four years.

The paper which I now submit to the Society includes the detailed statement of results acquired from the Equisetineæ and Lycopodineæ.